DOCUMENT RESUME

ED 314 841 EA 021 530

AUTHOR Owens, Thomas; McClure, Larry
TITLE New Developments in Improving the Integration of Academic and Vocational Education. Program Report.
INSTITUTION Northwest Regional Educational Lab., Portland, Oreg.
SPONS AGENCY Office of Educational Research and Improvement (ED), Washington, DC.
PUB DATE 1
CONTRACT 400-86-0006
NOTE 30p.
PUB TYPE Reports - Descriptive (141)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Academic Achievement; *Academic Education; Cooperation; *Curriculum Development; Educational Development; *Integrated Curriculum; Secondary Education; Teacher Education; *Teaching Methods; *Vocational Education

ABSTRACT

Challenges exist in secondary education, and new developments are being made in the area of integration of academic and vocational education. The first section of this paper focuses on the need for integration and provides a conceptual framework for viewing academic and vocational integration as well as teacher collaboration. Section two summarizes key features of some consortium-developed applied curricula intended for secondary vocational education students. In the third section successful practices in improving academic performance of vocational education students have been grouped into five categories: (1) those occurring within a single class; (2) between two classes; (3) across a school; (4) beyond the school; and (5) at the state level. Section four outlines preliminary findings, by the National Center for Research in Vocational Education, on efforts to integrate academic and vocational education. The last section examines recommendations at the district, state, regional, and national levels for vocational and academic teachers to collaborate, and for integrating the two disciplines in teacher education. (49 references) (SI)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

SCOPE OF INTEREST NOTICE

The ERIC Facility has assigned this document for processing to:

In our judgment, this document is also of interest to the Clearinghouses noted to the right. Indexing should reflect their special points of view.

THE Northwest Regional Educational Laboratory

PROGRAM REPORT

ED314841

New Developments in Improving The Integration of Academic and Vocational Education

Paper Prepared by

Thomas Owens and Larry McClure
Education and Work Program

August 1, 1989

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

X This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Jerry D. Kirkpatrick

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Northwest Regional Educational Laboratory
101 S.W. Main Street, Suite 500
Portland, Oregon 97204

Sponsored by OERI Office of Educational Research and Improvement U.S. Department of Education

EA 021 530

BEST COPY AVAILABLE

This publication is based on work sponsored wholly, or in part, by the Office of Educational Research and Improvement (OERI), Department of Education, under Contract Number 400-86-0006. The content of this publication does not necessarily reflect the views of OERI, the Department, or any other agency of the U.S. Government.

New Developments in Improving the Integration of Academic and Vocational Education

Paper Prepared by

Thomas Owens and Larry McClure
Education and Work Program
Northwest Regional Educational Laboratory
101 S.W. Main Street, Suite 500
Portland, Oregon 97204

August 1, 1989

NEW DEVELOPMENTS IN IMPROVING THE INTEGRATION OF ACADEMIC AND VOCATIONAL EDUCATION

The challenges facing American education today have been described clearly in numerous reports dealing with school reform ever since A Nation at Risk in 1983. One of the latest to state the challenge from an international perspective is the recent report by the American Society for Training and Development entitled Training America: Learning to Work for the 21st Century. The report states:

> In an era when competitive advantage is fleeting, when change is constant, and the whole globe is home base, America needs a new vision of success. In the face of rapid change, the first recourse of a nation, an institution, or an individual is the ability to learn quickly. The hard truth is that the United States has not invested in that ability while other nations have, and consequently we are not competitive in the global marketplace. We are reaping the scant harvest of our neglect—a learning deficit in our workforce as threatening to the economy as our monetary deficit...
>
> Our school systems teach too few of today's most necessary work skills, and the teaching is too far removed from its application to real work. Moreover, the education system does not provide adequate work skills to the sixty-one percent of students who do not go on to college. Of these, many fall completely from the life and prosperity of the nation because that nation has not prepared them to participate.
>
> Most thinking about how to educate people for work, whether in school or elsewhere, is as outdated as an old-fashioned assembly line. Work-related learning has changed the same way work itself has changed, from a linear process to an organic one characterized by continual growth. Over the years, the point of learning has moved closer and closer to the point where goods and services are produced, yet the American learning system still functions as if learning and work should be separate. We no longer have the luxury of learning first and then working." (Galagan, 1989, 2-3)

This paper focuses on challenges existing in secondary education, the need for integration of academic and vocational education, a framework for viewing collaboration, a summary of some models and effective practices, preliminary outcomes, and a statement of our view of the job remaining ahead.

THE NEED

Legislative Testimony

The "Applied Technology Education Amendments of 1989" (H.R. 7) are based upon legislation introduced by Congressmen Sawyer, Payne, and Poshard, H.R. 1787. The Committee heard witness after witness describe the problems of businesses that were forced to hire persons who were too narrowly trained in specific vocational skills and who lacked basic academic skills. Employers were said to need a larger pool of individuals with a more balanced educational background—one that includes both vocational and academic skills. The academic skills needed include not only the traditional skills of reading, writing, and arithmetic, but also more advanced skills of thinking, problem solving, and comprehension.

In testimony the National Tooling and Machining Association pleaded with the Committee to encourage a blending of vocational and academic education. It said:

> We need to stop the controversy about academic versus vocational. These components must be strong parts of one effective educational system and it must emphasize the world of work, working values and workplace literacy. Improving the quality of vocational education programs ought to be the new national Federal role for vocational education.

Testimony was also given that some secondary students appear motivated to achieve only when the academic curriculum was directly connected with real life applications.

Vocational Studies

In a recent study of 893 vocational classrooms in 120 high schools across 24 states, (Weber, Puleo, and Kurth, 1989) it was found that although basic academic skills were observed as part of the ongoing instruction in 62 percent of the cases, explicit attempts to enhance basic skills were noted in only two percent of the cases. "Even though teachers are aware that vocational education classes are rich in opportunities to reinforce/enhance basic academic skills, they (1) assign a low priority to that activity and (2) make relatively few explicit attempts—especially with regard to areas of reading and writing—to facilitate the development or transfer of such skills within the vocational context." (p. 42) When teaching basic skills, vocational teachers use traditional methods similar to those used by non-vocational teachers rather than those more appropriate to individualized and small group instruction.

Other Concerns

The recently completed National Assessment of Vocational Education (Wirt et. al, 1989) empirically tested the idea that high school vocational education contributes to the development of students' academic skills and that some students learn academic skills more readily in an applied context. Using data from a nationally representative sample of students from the high school class of 1982 they found that: 1) math-related vocational courses, as structured in the early 1980's, provided fairly low level applications of mathematics, 2)\math-related vocational courses accounted for approximately 18 percent of all vocational courses for all students, 3) for college-bound students, participation in a specific vocational math course (such as business math) increased math proficiency the equivalent to the contribution of algebra 11, and 4) the effects of applied math and specific vocational math are substantially higher for the college-bound than for the noncollege-bound group (p 79-81). The NAVE study concluded that "an objective of federal policy in vocational education should be to encourage the expansion of academic learning in vocational education and the integration of academic and vocational curricula." (p.83).

In their report on the second annual staff development conference of the Southern Regional Education Board-State Vocational Education Consortium, Bottoms and Korcheck lay out an excellent statement of the need for integrating academic and vocational education. They state: "The thinking and problem-solving skills of high school students will develop more readily if they understand the connection between what they are learning and how it can be used. One way students can achieve this insight is if meaningful applied learning activities are integrated into communications, mathematics, and science courses and if essential concepts and skills from these courses are coordinated with instruction in vocational courses. Once students understand the application of academic knowledge, they are far more likely to recall and apply information than if they rely on rote memorization." (p.16).

In summarizing public hearings in four cities across the country in 1989 the Commission on Workforce Quality and Labor Market Efficiency described seven elements as important to drop-out prevention and school-to-work transition programs for at-risk youth. The first of these elements stated that " The curriculum should be job relevant and integrate vocational and academic education. It should also emphasize the teaching of applied basic skills and general occupational training..." (p. iii).

Recent analysis of national data on high school students by Educational Testing Service (Applebee, Langer, and Mullis, 1989) indicate that "Sixty-one percent of the 17 year-old students could not read or understand relatively complicated material, such as that typically presented at the high school level. Nearly one-half appear to have limited mathematics skills and abilities that go little beyond adding, subtracting, and multiplying with whole numbers. More than one-half could not evaluate

the procedures or results of a scientific study, and few included enough information in their written pieces to communicate their ideas effectively." (p 26).

The ETS study concludes that "For qualitatively different gains to occur, the goals of instruction need to be reconsidered. Teaching decisions were once guided by a hierarchy suggesting that students must first learn the facts and skills and later learn to apply them. Yet many educators now recognize the limitations of this steppingstone view of education. Educational theory and research suggest a different pattern of generative teaching and learning, where learning content and procedures and how to use this learning for specific purposes occur interactively... When students engage in activities that require them to use new learning, both their knowledge of content and skills and their ability to use them develop productively together." (p.40).

In the regional study of entry-level workers in the Northwest and Pacific (Owens, Lindner, and Cohen, 1989) employers reported a growing gap in the level of basic skills needed by employers and those available in the applicant pool for entry level positions. Mentioned most often were serious deficiencies in reading, writing, mathematics, communications, and problem solving skills.

A Framework for Viewing Academic and Vocational Integration

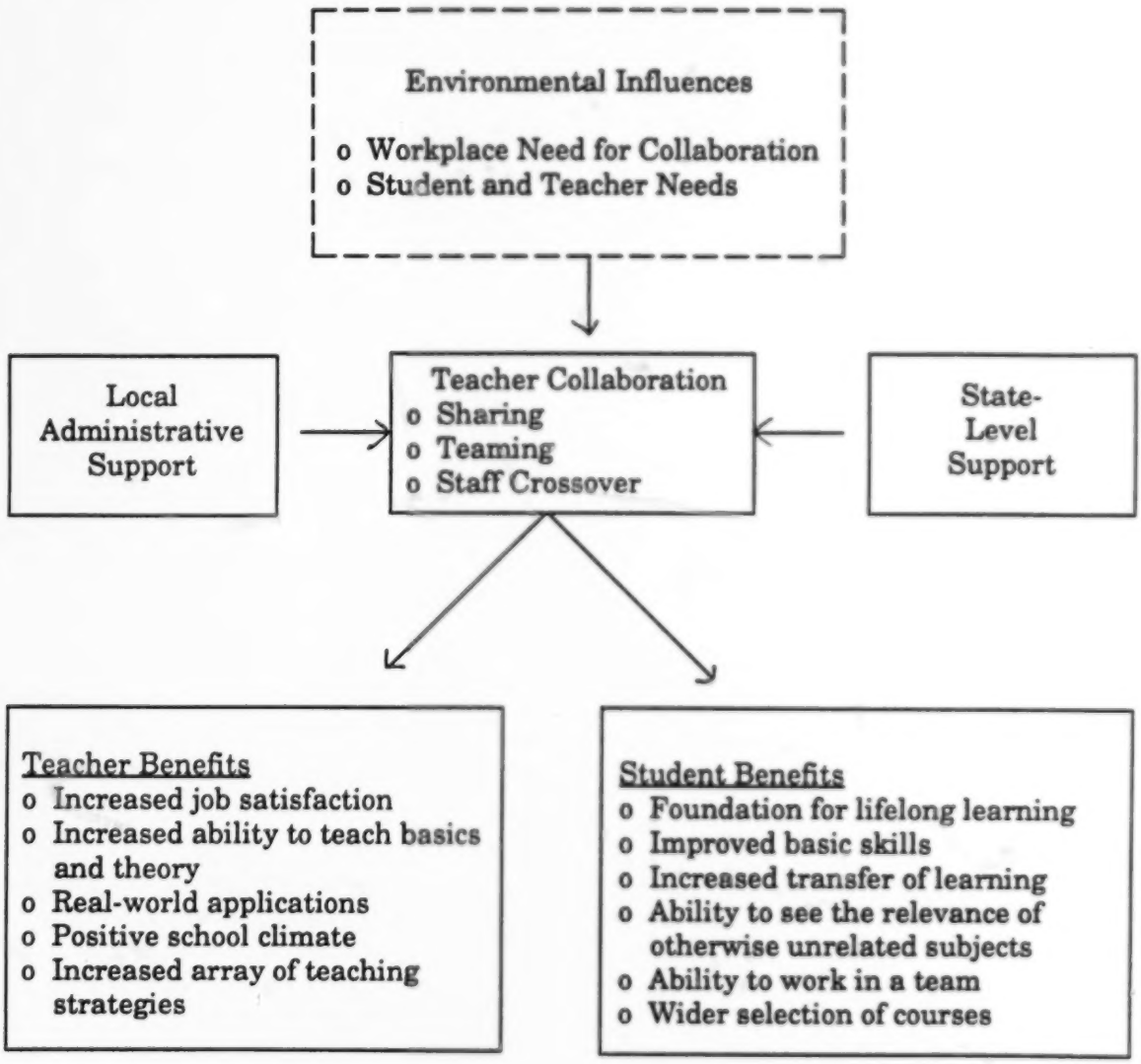
A conceptual framework, such as that shown in figure 1, can be useful in identifying the factors that influence cooperation between academic and vocational teachers and the student and teacher benefits resulting from it.

As many recent studies point out, the future workplace requires cooperation rather than competition, skill in acquiring, rather than remembering new knowledge, and practice in solving problems. Such workplace skills can be developed today by teachers who are willing to learn them and by administrators who act on the belief that cross-department cooperation is beneficial to teachers and students.

The need for collaboration comes not only from the workplace but also from the needs of students and teachers. Teacher needs include those for job satisfaction and the rewards of seeing students see relevance in what they are learning. Student needs include the need for applying what they learn and the satisfaction of working with each other.

FIGURE 1

A FRAMEWORK FOR TEACHER COLLABORATION


Environmental Influences
o Workplace Need for Collaboration
o Student and Teacher Needs
Local Administrative Support
Teacher Collaboration
o Sharing
o Teaming
o Staff Crossover
State-Level Support
Teacher Benefits
o Increased job satisfaction
o Increased ability to teach basics and theory
o Real-world applications
o Positive school climate
o Increased array of teaching strategies
Student Benefits
o Foundation for lifelong learning
o Improved basic skills
o Increased transfer of learning
o Ability to see the relevance of otherwise unrelated subjects
o Ability to work in a team
o Wider selection of courses

Recognition of the importance of teacher cooperation in order to help students, needs to be effectively communicated to teachers. Just as business leaders need to establish and communicate a vision of what is needed, and establish priorities and strategies for achieving it (as described by Peters and Waterman in their book In Search of Excellence), so do local and district school administrators (Owens, 1984). Support is also needed at the state level. In many states, however, vocational education staff members seldom see or interact with others in the department of education. As a first step, these staff have to learn about one another and examine how they can work together to support all students. Once this is done, language arts supervisors, for example, can provide workshops to vocational and academic teachers explaining how to enhance written skills, regardless of the subject area taught. With local and state support, high school staff can creatively demonstrate cooperation.

In their publication from the former National Center for Research in Vocational Education, at Ohio State University, Techniques for Joint Effort: The Vocational-Academic Approach, Pritz and Crowe (1986) describe three cooperative models: sharing, teaming, and staff crossover. In sharing, academic and vocational teachers use the same curriculum plans and resources. In teaming, vocational and academic teachers develop a correlated course of study and share teaching. In staff crossover, teachers exchange roles and may teach each other's classes.

In presenting Figure 1, we recognize that teacher cooperation is unlikely to be embraced enthusiastically unless teachers are convinced that there are real benefits not only for students but also for themselves. Therefore, it is important to note teacher benefits that can be demonstrated. First, vocational teachers learn effective strategies for teaching basic skills and for teaching the theories that lie behind occupational skills. In return, academic teachers learn to help students apply their basic skills to careers that interest them.

Increased cooperation can lead to a general sense that teachers use working as a team to build a positive school climate and attain school-wide goals. This feeling of teamwork can be fun and generate excitement in teachers who have become bored, frustrated, and lonely. Finally, teachers can acquire new teaching techniques, as did one high school math instructor who worked with a drafting teacher to develop computerized applications of math.

All of this discussion about teacher cooperation would be pointless if it failed to have positive benefits for students. A payoff for vocational students should be an improvement in their basic skills applications and in their ability to transfer learning across disciplines. Academic students learn real-world applications of what could otherwise appear to be unrelated subjects. Students in both tracks learn the skills of cooperation, and, where equivalent credit is available, students can choose from a wider selection of courses.

Another way of classifying the integration of vocational and academic education is being used at the NCRVE by Norton Grubb at Berkeley and Jane Plihal at the University of Minnesota. They have developed a five stage continuum described by Benson (1989) and summarized below:

Stage 1: Requiring more academic coursework of vocational students, or establishing academic prerequisites before taking vocational sequences. This is not true integration but it does respond to complaints about academic skill deficiencies of vocational students.

Stage 2: Including or reinforcing academic skills in existing vocational courses. This can be done either by including basic skills modules, taught either by vocational or academic teachers, or by including modules on problem solving, critical thinking skills, and other higher-order abilities.

Stage 3: Using the "applied academic" curricula such as Principles of Technology, Applied Communications, Applied Mathematics, and Applied Biology/ Chemistry (now in development).

Stage 4: Using new curricula designed locally. These again take many forms and may merge related subjects into a new subject such as "family social science" or redesign an entire curriculum.

Teacher cooperation can be achieved either by sharing curriculum plans and resource but continuing to teach independent classes; team teaching, in which vocational and academic teachers teach together; or crossover, in which academic and vocational teachers exchange roles and teach each other's classes.

Stage 5: Integrating the entire high school such as "specialized, career-oriented high schools."

OVERVIEW OF EFFECTIVE PRACTICES

Effective practices can be viewed from a number of perspectives. This section will summarize key features of some consortium-developed applied curricula intended for secondary vocational education students and then depict some regional, state, and local efforts to improve academic performance of vocational education students.

Applied Curricula

The most widespread of the national curricula dealing with applied academics is an applied physics curriculum called Principles of Technology. This curriculum will be described followed by a description of Applied Mathematics, Applied Communications, Applied Biology/Chemistry, and Materials Science Technology.

Principles of Technology

Principles of Technology—often called just PT—has completed its second full year of implementation in some 1200 sites nationally. The materials were cited as the best technical physics curriculum available by the American Association for the Advancement of Science in their 1988 review of materials. PT was developed by a consortium of 47 states and two Canadian provinces. It is a high school course in applied science aimed particularly at vocational-technical students. For them, a theoretical course designed for college-bound students did not seem to meet their need to better understand the behavior (and misbehavior) of modern technology.

The curriculum covers 14 units of study in a two-year period—though many schools choose to offer only the first seven in a one-year course. The 14 units of study include: force, work, rate, resistance, energy, power, force transformers, momentum, waves and vibrations, energy converters, transducers, radiation, optical systems, and time constraints.

There are several unique features of this "packaged" curriculum:

- a teacher's guide spells out exactly what each unit covers and what the instructor needs to know and do
- each unit opens with a video (78 in all) that motivates students to consider that particular principle as it applies in mechanical systems, fluid systems, electrical systems, and thermal systems
- students then observe a teacher demonstration and use their own text to work at a lab station shared by 1 to 3 other students

- math skills are carefully assessed at each step; math labs are part of each unit to assure that students can handle the computations required for each activity

PT is being taught by science teachers, vocational teachers and by teams in some schools. Some special training is required and time is needed to make sure each laboratory exercise is set up correctly for each unit. High schools may choose to offer students elective credit in science, vocational education and/or math depending on local and state policies.

Applied Math

With the financial assistance of 42 State Vocational Education Agencies and the guidance of mathematics and vocational educators, the Center for Occupational Research and Development (CORD) developed 25 units of Applied Mathematics. The materials were designed to meet the needs of students in the middle fifty percent of the high school population. The 25 units consistently use hands-on activities and work applications to transform abstract concepts into concrete experience. In the 1988-89 school year nearly 250 schools in 42 states taught Applied Mathematics to an estimated population of 7000 students.

The overall course includes material that focuses on arithmetic operations, problem solving techniques,estimation of answers, measurement skills, geometry,data handling, simple statistics, and the use of algebraic formulas to solve problems. The materials are designed to be used in a one-year course for academic credit toward high school graduation. Alternatively, they may be used in part and infused, as needed, into existing vocational courses. They are written generally at an eighth-grade reading level. The materials are deemed appropriate for high school students in grades 9 through 12 who are not necessary baccalaureate-bound.

Applied Communications

Applied Communications has been developed by the Agency for Instructional Technology as a practical curriculum to teach students the communications skills that the workplace demands. It was developed in conjunction with state departments and provincial ministers of education, instructional technologists, and educators in 42 states and provinces. The learning materials are divided into 15 instructional modules and include a total of 150 lessons. They can be used to broaden existing courses or used as the basis for a year-long course. Each module includes a series of ten 40-55 minute lessons incorporating a variety of learning activities and experiences.

Lessons 1 through 7 of each module provide instruction and practice in communications skills as they are generally used in the workplace. Lessons 8 through 10

feature activities designed to develop and refine communications skills in five major occupational areas: agriculture, business/marketing, health occupations, home economics, and technical/trade/industrial. Each module features two video programs. The student work-text for each module supplies the material for student activities—individual task sheets with lists of goals and objectives, background information, observation checklists, self-evaluation forms, worksheets, schedules, letters, and charts.

Applied Biology/Chemistry

The Applied Biology/Chemistry curriculum is in the early stages of development by CORD in conjunction with state directors of vocational education, state science consultants, and vocational and academic teachers. The prototype unit "Natural Resources" will be pilot tested in September and October,1989. The curriculum will be a modular, competency-based instructional system that can be presented as a separate course or infused into existing courses. It will be designed as a two-year course of instruction with the first year being developed and field tested prior to development of the second year. It may be used in any of grades 9-12 but is not intended to replace traditional biology, chemistry, or vocational courses. It will present the concepts and processes of science and technology in the context of concrete applications in society and work. Biology and chemistry will be integrated in a unified presentation. The curriculum will employ the science process skills of observing, classifying, using space-time relations, using numbers, communicating, measuring, inferring, predicting, interpreting data, controlling variables, defining terms, formulating hypotheses, experimenting, and developing models in hands-on laboratory and problem-solving activities. It will include up to 12 units, each with two to six instructional modules. Themes will deal with structure, function and classification with applications drawn for agriculture, trades and industry, home economics, technologies, health occupations, and environmental.

Modules planned for 1989-90 include: natural resources, synthetic materials, air and other gases, water, and other liquids, community of life, plant life processes, plant nutrition, animal life processes, animal nutrition, continuation of life, disease and wellness, and waste management. The prototype unit will be pilot tested in September with 70 schools across the country.

Materials Science Technology (MST)

The MST curriculum is a course initially developed by Steve Piipho, an industrial arts teacher at Richland, Washington in cooperation with scientists and technical specialists from Battelle Pacific Northwest Laboratories and local volunteers. MST focuses on emerging materials that have a profound impact on products and processes in today's manufacturing works: polymers, ceramics, composites, and alloys. However, traditional woods, metals and plastics can also be addressed using the

MST process. The essential ingredient at the Richland pilot site has been a partnership between educators and industry experts supplemented by volunteers from other fields such as jewelry-making. Students are required to keep scientific journals of their activities to practice notation skills used by scientists. Math skills are utilized in every project activity. Seven new sites in Washington and Oregon will try out the curriculum in 1989-90.

EFFORTS TO IMPROVE ACADEMIC PERFORMANCE OF VOCATIONAL EDUCATION STUDENTS

One of the most widespread efforts to strengthen the basic skills of vocational education students is the SREB- State Vocational Education Consortium. This consortium involves the Southern Regional Education Board and 13 southern states. It's purpose is to advance, apply, and evaluate approaches that will strengthen the development of the basic competencies—communication, science, mathematics, critical thinking, and problem solving— of students enrolled in vocational programs. The Consortium provides a cost-effective method of field testing strategies and approaches that will allow students enrolled in vocational education to strengthen their knowledge and application of the basic competencies that are essential to further learning and employment. Gene Bottoms is the director of this consortium.

Consortium activities are based on the shared beliefs that:

- Instruction in both vocational and non-vocational courses provides the method or means for helping students develop the basic competencies.

- Some students learn better through the direct application of concepts; others, through the more traditional abstract or theoretical approach. Helping students develop the basic competencies will be greatly improved by matching each individual student with the appropriate balance of theory and application.

- Because students in vocational programs spend a majority of their time in non-vocational courses, the entire secondary school curriculum and faculty must be involved in the development of strategies to strengthen the basic competencies of students enrolled in vocational education programs.

Each member state has agreed to establish a pilot site where strategies will be implemented to:

- Strengthen the teaching and content of basic competencies in vocational courses.

- Allow students to earn required graduation credits for vocational courses identified as being equivalent in knowledge and skills to certain mathematics, science, and communication courses.

- Redesign courses to teach content from college preparatory courses—mathematics, science, and communication—through an applied teaching process that will more effectively motivate and challenge students enrolled in vocational courses.

- Raise expectations and standards for secondary vocational completers.

- Develop links between secondary and postsecondary education that will encourage more students completing a secondary vocational program to continue their studies after graduation from high school.

Consortium members are evaluating the outcomes of these pilot sites. The results will be used in seeking support of state policymakers for expansion of the most promising approaches. The National Center for Research in Vocational Education is also evaluating these efforts.

Through the Consortium, states are receiving greater benefits than if they worked independently. Not only are the expenses of planning and development shared, but all Consortium states gain from the results of the various field-tested strategies. In addition, the Consortium is providing many other benefits to its member states by:

- Promoting effective examples of approaches that strengthen the basic competencies of vocational students and convening regional workshops to encourage state and local educators to utilize these proven approaches.

- Identifying experts in the teaching of basic competencies to secondary students and coordinating their services as consultants to the states.

- Providing in-depth regional staff development and in-service programs to prepare administrators and teachers to implement the strategies.

- Convening state governmental and educational leaders to make them more aware of the need for state support for Consortium activities.

- Distributing, on a regional and national basis, written materials that inform and promote strengthening the basic competencies of students enrolled in vocational programs.

Results from the 1988 baseline assessment of the SREB-State Vocational Education Consortium using the National Assessment of Educational Progress tests in reading, mathematics, and science indicated the reading and mathematics achievement of SREB site vocational completers were significantly above the national average for students nationwide who indicated they were vocational students. Science achievement was at the national average. (Bottoms and Korcheck, 1989, p. ii) Data from future testing will portray the relative growth in basic competencies by the SREB participating students.

Successful practices for integrating academic and vocational education have been grouped by NWREL into five categories: 1) those occurring within a single class;

2) between two classes; 3) across a school; 4) beyond the school; and 5) at the state level. Examples are given here for all five levels. These examples come from case studies in the Northwest although similar practices are occurring in other parts of the nation. (Owens, 1988)

1. In Class

- In a math class, students are required to measure the same lengths with several measuring tools that are used in home economics. They study units of length, compare the quality of tools involved, learn to double-check their calculations, and master methods for measuring difficult-to-reach areas. Measuring devices include tapes, protractors, and T-squares.

- Teachers in a Principles of Technology class show videotapes demonstrating how concepts from physics are being used in various occupations.

- A math teacher uses Ohm's law as an example in the algebra class.

- A language arts teacher wants students to understand roadblocks to communication. She explains different types of roadblocks such as ordering, threatening, preaching, blaming, psychoanalyzing, and name calling. Each roadblock is put on a note card and students are given one to roleplay, using their personal or work experiences.

- A home economics teacher asks students to plan and prepare an unexpected meal for someone special in 30 minutes using only groceries on hand. Students must use brainstorming techniques they were taught and evaluate two or three possible choices.

- An industrial mechanics class has students learn sequencing to perform a job skill at the same time that they practice written and oral communication. Students select a skill to demonstrate, write out step-by-step instructions, have another student observe them following the directions in proper sequence, recite the directions (checking for grammatical errors), and then give oral directions to a different student to see if that person can perform the skill desired.

2. Between Classes

- Vocational teachers make up a weekly list of occupational terms that students must learn to use and spell correctly in their English class.

- In electronics class juniors study direct circuits, while in science they analyze electronic motors.

- A business education teacher provides a sample form letter and suggestions for agriculture students who need to write away for free or inexpensive farming materials.

- Science and vocational education teachers work together to develop and operate an environmental science class in a 40-acre woodland nature preserve. Among other things, students construct salmonoid egg-hatching boxes and establish a migratory fish run in a local stream. Biology and botany classes identify trees and plants which woodworking and metals classes mark with specially designed plaques.

- Vocational students are tested in math, and those with low scores are tutored twice a week by volunteer students from their particular occupational areas. Each student has a list of skills to be mastered and can proceed at his/her own pace.

3. School Level

- Academic and vocational teachers have set up a school-wide problem-solving program for students, and a file of problem-solving exercises has been set up for teachers in the staff resource center.

- In a school-wide oral language project, teachers agree to help students spot and overcome the use of double negatives, incorrect verb tenses, and improper usage.

- Recognizing the need for students to use better study skills, teachers at a junior high school write a one-week curriculum on study skills for use by all teachers in the first week of school.

- Vocational teachers conduct several informal evening classes for other teachers who want to learn more about a vocational area.

- The Basic Skills team in Idaho distributes problem-solving posters to the rest of the faculty who display them. Charts explaining the elements of good writing are also used.

4. Beyond the School

- Seniors interested in learning the math needed for a technological society receive instruction from their vocational-technical teachers, who invite local tech-college instructors to consult with them and their classes.

- As one way of gaining first-hand experience in writing, students in a cooperative office education program interview secretaries or general office workers and request sample letters and memos for review.

- Students enhance basic math skills by preparing a monthly budget to determine how much money they need to make in their entry-level positions. Families support the project by helping students determine costs for utilities, insurance, and other monthly living expenses. Others in the community are asked to provide information about prices.

5. State Level

- Interagency articulation seminars initiated this year in Idaho bring together key staff from the State Department of Education and the State Division of Vocational Education. This group has planned and initiated a statewide Basic Skills Project in ten districts and is discussing Principles of Technology, Applied Math, and Applied Communications.

- A one week Linear Measurement Unit, developed by the Basic Skills Project in Idaho, has been distributed to all trade and industry instructors in the state, as well as to all Basic Skills team members in 10 districts. This unit can be taught in math or vocational courses to fill the gap found in students' understanding of measurement.

PRELIMINARY OUTCOMES

The National Center for Research in Vocational Education is in the process of evaluating a number of efforts to integrate academic and vocational education. (Benson, 1989). Their preliminary findings are that:

- The basic skills and academic content included in vocational courses increases, as vocational teachers make more explicit the academic foundations of various occupations and as academic teachers find more vocational examples appropriate for integrated classes.

- The rigor of vocational courses is increased with the greater use of academic material and of "applied academic" courses.

- The teaching of academic subjects often improves as academic teachers learn to use more applications and more problem-oriented approaches in their teaching.

- The content of the curriculum is upgraded as "general" courses—often watered-down academic courses—are replaced with more rigorous "applied academic" courses.

- The coherence of the high school curriculum is improved as vocational teachers, academic teachers, and counselors work together to define coherent sequences of courses and four-year programs of study that contain appropriate amounts of both academic and vocational subjects.

- The patterns of segregation of vocational and academic teachers, and the suspicion of each other's teaching, have been broken down as teachers work with each other on new curricula, and gain a better understanding of the strengths of each other's approaches.

- In a few cases the segregation of academic and vocational students has been reduced, by developing courses and even entire programs in which the divisions between "academic" and "vocational" subjects are eliminated.

- Teachers—both vocational and academic—begin to share a sense of excitement about teaching, particularly as they find out how many ways they can improve their teaching through collaboration; and students become more excited about learning as they see more clearly the applications and the future importance of school-based learning. (p. 12-13)

Applied Academic Exchange

One approach by NWREL to promoting academic/vocational integration in Northwest schools and colleges has been an informal Applied Academic Exchange designed to build a network of interested educators. A periodic bulletin bearing that same name was established in 1987 to provide a forum for teachers and administrators. A major part of the Exchanges distributed to date has been news and views on Principles of Technology, Applied Mathematics, Applied Communication, Materials Science, and the new Applied Biology/Chemistry.

Feedback from readers indicates that they prefer a single bulletin containing information about various applied curricula and other teacher practices rather than separate bulletins each focusing on a single curriculum such as Applied Mathematics.

NEXT STEPS

Case studies of local programs to implement applied academics curricula such as Principles of Technology and local efforts to encourage vocational and academic teachers to collaborate are presenting some very positive outcomes. In this section we examine some next steps needed at the district, state, regional, and national levels and in teacher education.

1. District Recommendations

   Case studies of efforts to integrate academic and vocational education indicate that three of the biggest obstacles to integration are: 1) the lack of administrative and community support, 2) lack of adequate time for teachers to prepare together and share experiences; and 3) the lack of training in ways to implement integration. Related to these obstacles we recommend that:

   - School boards and superintendents examine the importance of students receiving a work-relevant education and develop district policies and procedures that address the need for teacher inservice in this area, awarding of academic credits, incentives to teachers for collaboration, and provision of time for teachers to plan and work together. Teachers also need to receive time and encouragement to visit classes and schools where effective collaboration is occurring. Districts need to provide leadership models of academic and vocational supervisors working together to plan and train teachers for such collaboration.

   - School districts can learn from the experiences of effective vocational advisory committees to have employer advisory committees for all academic areas in the secondary curriculum. Such committees could identify relevant business and industry applications that could be incorporated into the academic curricula.

   - Teams of academic and vocational teachers should be encouraged to use professional development days for exploration of local employer sites to learn of changes in the workplace and of industrial examples to apply in their classrooms.

2. State and Regional Recommendations

   - In some states the turf issues that separate vocational education from the rest of the department of education need to be examined and incentives developed to encourage these staff to work together. Once staff begin to think of the learning needs of the total child it becomes possible for real cooperation to occur. An example occurred in one state where after a year of vocational

and academic supervisors starting to communicate , several vocational educators started to serve on a committee to look at the needs of primary grade children.

- States can play a major role in encouraging innovative and effective applied curricula by approving such curricula for vocational credit. In cases where there is adequate academic content such as applied math, they can also encourage districts to award math credit for students completing such courses.

- Several states have demonstrated support for integrating academic and vocational education by holding state-wide or regional annual networking meetings for teachers of applied academic curricula. Such meetings can focus on a single curriculum such as Principles of Technology or cut across such curricula. Regional conferences that bring together local teachers to share exemplary collaborative practices such as the annual conference of the Southern Regional Educational Board or the Work Now and in the Future conference by NWREL are effective strategies for encouraging teachers to share and learn from each other.

- In his testimony to Congress, Benson proposed that the Office of Educational Research and Improvement within the Department of Education consider having some regional educational laboratories and national centers include in their scope of work the collaboration with "states and organizations such as NCRVE (The National Center for Research in Vocational Education) and NOICC (The National Occupational Information Coordinating Council) to provide assistance to vocational programs" (1989, p. 25) Laboratories such as NWREL could provide leadership in holding regional conferences on integrating academic and vocational education, provide a human and materials clearinghouse, school and district based technical assistance, training of state level staff, and coordination in program evaluation.

3. National Recommendations

- The National Center for Research in Vocational Education has already started conducting case studies and evaluations of practices to integrate academic and vocational education. The evaluation of such programs is complicated for the fact that effective and sensitive instruments for assessing outcomes of such programs and practices do not exist. The development of appropriate indicators and evaluation instruments by NCRVE would be a major contribution to the field.

- The Clearinghouse on Adult and Vocational Education has initiated an ERIC synthesis report on integrating academic and vocational education which

should be useful to the field. This clearinghouse could also initiate a special multi-year effort to collect and disseminate reports and promising practices in this area.

- Continued research is needed to develop a clearer definition of terms like "applied academics, integration, basic skills, academic and vocational education." It will also be important to apply knowledge from neuroscience and learning theory to the applied learning context.

4. Teacher Educators

- Integration of academic and vocational education works especially well when vocational teachers have the broad based academic skills needed to teach such courses as Principles of Technology which is an applied physics course. This implies that in preparing vocational teachers for the future, colleges of education assure that all teachers have sound basic skills and that they have some academic training in areas such as science.

- The content of secondary "methods" courses needs to be re-examined in light of emerging trends to integrate academic and vocational studies. Thus, English teachers should be exposed to ways of integrating community and worksite applications into their courses.

- Colleges teaching educational leadership courses need to assure that master teachers and administrators are being trained in skills of helping vocational and academic teachers to work together. An understanding of change theory, conflict resolution, and team work skills is becoming essential and should be reflected in certification criteria.

REFERENCES

Adelman, N. (1989) The case for integrating academic and vocational education, NAVE Contract Report, Washington, D.C. Policy Studies Associates.

Agency for Instructional Technology (August 1989) Workplace readiness: Education for employment (personal behavior, group effectiveness, and problem-solving skills for a changing workplace.)

American Vocational Association (March, 1984) "Teaching the right stuff: Where it's happening today." Voc Ed Journal Vol. 59, No. 2.

Applebee, A; Langer J; and Mullis, I., (1989) Crossroads in American education. A summary of findings. Princeton, NJ; Educational Testing Service. Teachers College, Columbia University.

Bailey, T. (1989) Changes in the nature and structure of work: Implications for skills and skill formation. NY: Teachers College, Columbia University.

Barton, P. (March, 1989) Earning and learning: The academic achievement of high school juniors with jobs. Princeton, NJ: Educational Testing Service.

Benson, C. (July 1989) Testimony of Charl s Benson on integrating academic and vocational education. Presentation to the Senate Subcommittee on Education, Arts, and Humanities, July 27, 1989.

Botkin, J., and O'Loughlin, A. (1987) Education for the 21st century: Compilation of issues and concerns. Compilation of comments obtained at the conference on Education for the 21st Century held at Harvard, October 28-31, 1987.

Bottoms, G., and Korcheck, S. (1989) Improving the communications, mathematics, and science competencies of students enrolled in vocational courses. Atlanta, GA: Southern Regional Education Board.

Bottoms, G., and Korcheck, S. (1989) Assessing the reading, mathematics, and science achievement of 1988 secondary vocational completers. Atlanta, GA: Southern Regional Education Board.

Budke, Wesley (1988) Trends and issues in vocational education. Columbus, Ohio: Center on Education and Training for Employment.

Burke, Gerald and Rumberger, Russel (ed) (1987) The future impact of technology on work and education. NY: Falmer Press.

Capper, Joanne (1988) Accelerated schools and accelerated learning. IL: North Central Regional Education Laboratory.

Carnevale, A., and Gainer, Leila J. (1989) The learning enterprise. Alexandria, VA: American Society for Training and Development, and Washington, D.C.: Government Printing Office.

Castor, B. (1989) Blueprint for career preparation: Tallahassee, FL: Florida Department of Education.

Copa, G., Plihae, J; Scholl, S; Ernst, L; Rehn, M; and Copa, P. (1985) An untold story: Purposes of vocational education in secondary schools. St. Paul, MI; Minnesota Research and Development Center.

Cotton, D. Active learning: A strategy for improving math and science education. Washington, D.C.'s National Institute for Work and Learning, in press.

Department of Labor (1989) Labor market shortages. Washington D.C.: U.S. Printing Office.

Dunham, D. (1989) Vocational Education in the secondary school: The case for continuation. Economics of Education Review, Vol. 8, No. 1, 69-74, London: Pergamon Press.

Campbell-Thrane, Lucille, (1983) Building basic skills: Models for implementation. Special Publication Series No. 41, The National Center for Research in Vocational Education, The Ohio State University.

Commission on Workforce Quality and Labor Market Efficiency. (July 1989) Public hearings: analysis of comments. Washington, D.C,: Technical Assistance and Training Corporation.

Crow, D. (1986) A step-by-step guide to integrating science concepts and vocational skills in the high school classroom: The Sandy Union High School experience. Sandy Union High School District #2, 17100 Bluff Road, Sandy, OR 97055.

Duggan, P., and Mazza, J. (1986) Learning to work—Improving youth employability. Washington, D.C.: Northeast-Midwest Institute: The Center for Regional Policy.

Education Commission of the States. (1983). Action for excellence: A comprehensive plan to improve our nation's schools. Denver: Task Force on Education for Economic Growth, Education Commission of the States.

Galogan, P. (1989) Training America: Learning to work for the 21st century. Alexandria, VA: American Society for Training and Development.

Halasz, I.M., and Behm, K.A. (1983). Time on task in selected vocational classes. Columbus: The National Center for Research in Vocational Education, The Ohio State University.

Hoffman, Kirby. "(August, 1985) "Put an Academic Teacher on Your Advisory Committee." Voc Ed Journal, Vol. 60, No. 5.

Incardone, Peter (1982) Teaching students to read better. Professional Development Series No. 6. The American Vocational Association (1410 King Street, Alexandria, VA 22314, 703-683-3111).

Johnston, William B., Workforce 2000. Indianapolis, IN.: Hudson Institute, 1987.

Kadamus, J.A., and Daggett, W.R. (1986). New directions for vocational education at the secondary level. Columbus: The National Center for Research in Vocational Education, The Ohio State University.

Lotto, L.S. (1983) Building basic skills: Results from vocational education. The National Center for Research in Vocational Education, The Ohio State University.

McClure, L. (1986) Options for equivalent credit in the high school curriculum: A guide for local decision making. Olympia, WA: Commission for Vocational Education.

Messier, P. (September, 1988) Neuroscience implications for educational research. Washington, D.C.: Office of Education, U.S. Department of Education.

National Association of State Boards of Education Curriculum Study Group (1988) Rethinking curriculum: A call for fundamental reform. VA: NASBE.

National Center for Research in Vocational Education (1989) The 1989 Agenda for the National Center for Research in Vocational Education. CA: University of California at Berkeley.

National Commission on Excellence in Education. (1983) A nation at risk: The imperative for educational reform. Washington, D.C.: National Commission on Excellence in Education.

National Science Foundation. (1983) Educating americans for the 21st century: A plan of action for improving mathematics, science and technology education for all American elementary and secondary students so that their achievement is the best

in the world by 1995. Washington, D.C.: The National Science Board Commission on Precollege Education in Mathematics, Science and Technology, NSF.

Owens, T. (1988) Improving the collaboration of secondary vocational and academic educators. Paper presented at the annual meeting of the American Educational Research Association in New Orleans, LA in April, 1988.

Owens, T. (August 1988) Vocational education for the future: Conference proceedings, Portland, OR: Northwest Regional Educational Laboratory.

Owens, T., Lindner, F., and Cohen, C., (1989) Entry-level worker study: phase 1 report, executive summary. Portland, OR: Northwest Regional Educational Laboratory.

Panel on Secondary School Education for the Changing Workplace. (1984) High schools and the changing workplace—The employer's view. Washington, D.C.: National Academy Press.

Polto, J., and Rehn, D. (March 1989), Full-scale curriculum integration. Vocational Education Journal.

Pritz, S.G., and Corwe, M.R. Techniques for Joint Effort: The vocational-academic approach. Columbus, Ohio: The National Center for Research in Vocational Education.

Ratcliff, E., (1987) Administrator's handbook for assembling a basic skills team and starting a basic skills project. Idaho State Department of Education.

Suter, Paul (August, 1984) "Teaching a new kind of shop talk." Voc Ed Journal, Vol. 59, No. 5:31.

Weber, J., Puleo, N., and Kurth, P. (Winter 1989) A look at basic academic skills reinforcement/enhancement efforts in secondary vocational classrooms. Journal of Vocational Education Research, Vol. 14, No. 1, pp. 27-47.

Weber, J.M., Puleo, N., Kurth, P., Fisch, M., and Schaffner,D. (1988) The dynamics of secondary vocational classrooms. Columbus: The National Center for Research in Vocational Education, The Ohio State University.

Wirt, V; Muraskin, L., Goodwin, D., and Meyer, R. (July 1989) Summary of findings and recommendations, U.S. Department of Education, National Assessment of Vocational Education.

Northwest Regional Educational Laboratory

Robert R. Rath, Executive Director
Ethel Simon-McWilliams, Associate Director

The Northwest Regional Educational Laboratory (NWREL) is an independent, nonprofit research and development institution established in 1966 to assist education, government, community agencies, business and labor in improving quality and equality in educational programs and processes by:

- Developing and disseminating effective educational products and procedures
- Conducting research on educational needs and problems
- Providing technical assistance in educational problem solving
- Evaluating effectiveness of educational programs and projects
- Providing training in educational planning, management, evaluation and instruction
- Serving as an information resource on effective educational programs and processes including networking among educational agencies, institutions and individuals in the region

Center for Advancement of Pacific Education
John Kofel, Director
Center for National Origin, Race, and Sex Equity
Ethel Simon-McWilliams, Director
Education and Work
Larry McClure, Director
Evaluation and Assessment

Literacy, Language and Communication
Stephen Reder, Director
Planning and Service Coordination
Rex Hagans, Director
R&D for Indian Education
Joe Coburn, Director
School Improvement
Bob Blum, Director
Technology
Don Holznagel, Director

Western Center for Drug-Free School and Communities
Judith A. Johnson, Director

Institutional Development and Communications
Jerry Kirkpatrick, Director
Finance and Administrative Services
Joe Jones, Director

Board of Directors

C.J. Baehr
Manager, Hawaii Interactive Television System

Charles Bailey
Education Director
Washington State Labor Council AFL/CIO

Robert D. Barr
Dean, OSU/WOSC School of Education
Oregon State University

Barbara Bell
Attorney
Great Falls, Montana

Judith Billings
Washington Superintendent of Public Instruction

Jacob Block (Vice Chairman)
Superintendent
Missoula Elementary District (Montana)

Raina J. Bohanek
Teacher
Coeur d'Alene School District (Idaho)

Catalino Cantero
Assistant to the Secretary for Education
Federated States of Micronesia

William Demmert
Alaska Commissioner of Education

Jean M. Dobashi
Teacher
Kauai High/Intermediate School (Hawaii)

Verne A. Duncan
Oregon Superintendent of Public Instruction

John W. Erickson
Superintendent
Lincoln County School District (Oregon)

Jerry L. Evans
Idaho Superintendent of Public Instruction

James E. Harris
First Interstate Bank, Portland

Richard L. Hart
Dean, College of Education
Boise State University (Idaho)

Shirley Holloway
Superintendent
North Slope Borough School District (Alaska)

Marlys Henderson
Teacher
Fairbanks School District (Alaska)

William Hensley
Northwest Alaska Native Associaton

Jerry Jacobson
Superintendent
Idaho Falls School District (Idaho)

Spike Jorgensen
Superintendent
Alaska Gateway School District

Homer Kearns
Superintendent
Salem-Keizer School District (Oregon)

Nancy Keenan
Montana Superintendent of Public Instruction

John Kohl
College of Education
Montana State University

Dale Lambert
Teacher
Eastmont School District (Washington)

Rosiland Lund
Teacher
Hillsboro Union High School District (Oregon)

Joe McCracken
Superintendent
Lockwood Elementary District (Montana)

Zola McMurray
Business Woman
Lewiston, Idaho

G. Angela Nagengast
Teacher
Great Falls High School (Montana)

Nancy W. Oltman
Director, EEO/Affirmative Action
Weyerhaeuser Company (Washington)

Barney C. Parker (Chairman)
Superintendent
Independent District of Boise (Idaho)

Dennis Ray (Secretary-Treasurer)
Superintendent
Walla Walla School District (Washington)

Patricia Rylander
Principal, Manchester Community School
Port Orchard, Washington

Henry Sablan
Commissioner of Education
Commonwealth of Northern Mariana Islands

James Scott
Headmaster
Catlin Gabel School
Portland (Oregon)

Anita Sukola
Acting Director of Education
Guam Department of Education

Brian Talbott
Superintendent
Educational Service District 101
Spokane (Washington)

Charles Toguchi
Superintendent
Hawaii Department of Education

Lealofi Uiagelelei
Director of Education
Government of American Samoa

Northwest Regional Educational Laboratory

101 S.W. Main Street, Suite 500
Portland, Oregon 97204
(503) 275-9500
GTE: NWREL.LAB
FAX: (503) 275-9489

Center for the Advancement of Pacific Education
1164 Bishop Street, Suite 1409
Honolulu, Hawaii 96813
(808) 533-1748
GTE: PREL.LAB
FAX: (808) 523-1741